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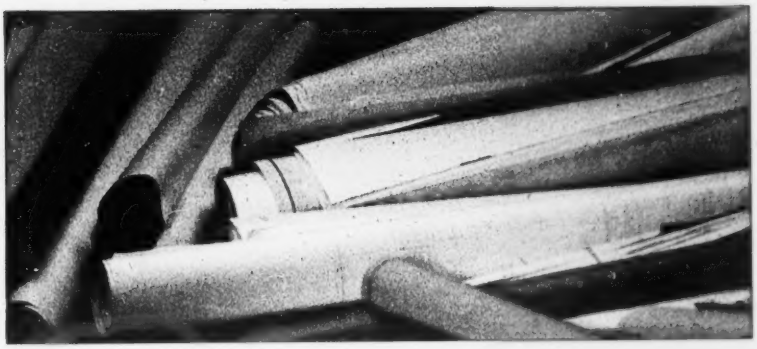
Special Report:

THE ENGINEERING CRUNCH 54

Projects stack up as shortage of engineers threatens continued growth

Volume 62
Number 9

SEPTEMBER



FOCUS: ENGINEERING

The engineering crunch 54
Special 16-article report examines engineering shortage from three perspectives: how it happened, ways to possibly solve it, and how to train and keep more engineers in the future

Assessment

56 Excessive expansion is pushing engineering capacity to limit, may curb growth

60 Engineering/construction industry must face manpower shortages, foreign competition

76 Shortage of key engineers has consulting firms turning away work, may slow growth boom

81 Reduced engineering staffs have paper companies relying on vendors and consultants

THE COVER

Record expansion/modernization projects in the North American paper industry have literally jammed engineers' desks as well as paper machinery factories and construction work schedules, exceeding manpower capacity and possibly causing a near-future growth slowdown. (See special section, "The Engineering Crunch," which begins on p. 54). **(Staff photo composed at Sandwell Swan Wooster Inc., Atlanta, Ga., by Kelly H. Ferguson.)**

Improving Effectiveness

91 Design effectiveness evaluation can help to improve the total design process

112 Dynamic process analysis aids project design, commissioning, and training and operation

116 Construction input early in project design phase is essential for cost-effective projects

128 Millwide automated process simulation allows for quick evaluation of proposed changes

130 Quality Performance Tracking System determines costs for construction quality

148 Engineering-procurement-construction concept can maximize project efficiency

153 Constructibility reviews in every phase of capital project result in lower costs

160 Partnerships between owners and contractors are needed to reverse declining productivity

Staffing/Training

171 *Pulp & Paper* survey analyzes engineers' progress in the paper industry in the past four years

192 Real-time modular simulator aids training on distributed process control systems

196 In-house programs train engineers for technical and process management positions

206 Paper schools under pressure to supply talent as industry demands more engineers

OTHER FEATURES

PAPERMAKING

The Sherator Roll 214
A newly designed table roll helps older machines to compete with newer ones by increasing tensile and speed and improving formation

Pressure screen design 233
Improvements in design of pressure screens have made paper machines more efficient; factors affecting operation and capacity are discussed

PROCESS AUTOMATION

Meter solves flow problems 216
Great Northern Paper Co. improves accuracy of dryer condensate flow measurement with venturi-element meter at newsprint facility

Mass flowmeters 224
Fine paper mill aids conversion to alkaline papermaking by installing 33 Coriolis mass flowmeters to improve accuracy of its wet end chemistry

EXPANSION/MODERNIZATION

CTMP line startup 227
In-house and outside resources helped MB to start up Powell River mill in record time—approximately 11 months from order to startup

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SEPTEMBER

COLUMNS

From the Editors 7
by Kenneth E. Smith
Engineers are people, too

Chemical Report 41
by Michael Ducey
Sulfite segments are up and down; chemicals cost more

Quality Report 243
by Lars Ingman
Predicting end-use performance

Career Development 247
by Roberta Bhasin
Succeeding at succession, Part III

Maintenance Management 259
by Christer Idhammer
Maintenance myths

Comment 322
by Craig Ferguson
We don't know Japan

DEPARTMENTS

Conference Calendar	43
News of People	249
Product Showcase	261
New Products	261
Product Review	279
Literature	281
Bookshelf	291
Supplier News	293

SERVICES

Reader Service Index	255
Reader Service Review	256
Reader Service Card	257
Professional Service Directory	298
Classified Advertising	300
Advertisers Index	320

NEWS

Month in Statistics 9
U.S. paper and paperboard production data for June

Market Report 11
North American mills may forego hike
Abitibi lifts some groundwood grades
Fall liner hike unlikely

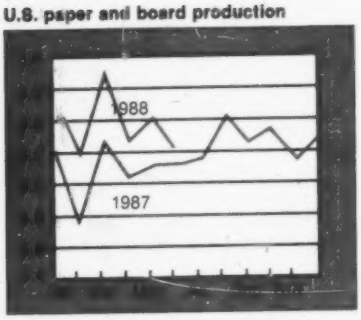
Grade Profile 13
Uncoated groundwood: Markets tighten, prices continue to rise in virtually all segments

NEWS SCAN

Second-quarter earnings surged	21
Canadian earnings rose	23
Makin to build coated paper mill	25
Island Paper Mills turns coated	25
Kenaf International delayed	25
Millar Western begins shipments	27
Maclaren to expand capacity	27
Federal upgrades Riegelwood	27
Cascades starts up bleach plant	27
L-P signs wood agreement	29
MB starts up No. 9 machine	29
Settsu buys 9.6% stake in USG	29
Labor agreement ratified by 71%	29
IP agrees to payment of OSHA fine	29
IWA-Canada vote on new contract	31
Willamette strike ended	31
G-P starts linerboard machine	31
Virginia Fibre to lift capacity	31
Federal to sell mill	33
World liner exports rose 5.4%	33
Recycled linerboard mill studied	35
Warren shuts down machine	35
James River buys Fuji technology	35
Mead says Cycolor could be big	35
Portals security paper mill sold	35
Nocopi develops new process	37
EPA to set dioxin guidelines	37
Firm buys Universal Packaging	37
Management buys out Princeton	37

International News 39
Courtaulds to sell some interests
Finland sells part of stake in Valmet
Brazilian companies plan to expand
France slates two newsprint machines
Sanyo-Kokusaku orders machine
Kaysersberg cuts back on expansion

U.S. paper and board production



U.S. paper and paperboard production totaled 6.2 million tons in June, an increase of 1.7% over the same month last year, the American Paper Institute reports. On a seasonally adjusted basis, production through the first half of the year was at a record rate of 76.5 million tpy, up 4.2% from 1987. After growing at a rate of 5.4% for the four quarters of 1987, however, production growth has slowed considerably in 1988, API reports. The annual rate for the first two quarters of 1988 was just 2.0%, reflecting 3.0% growth for paper and only 0.4% for paperboard.

Among major grades, printing and writing papers continued strong in June, with the highest growth in coated papers, up 11.2% from last year. Reflecting tight markets, unfilled orders for uncoated freesheet were up 45.6% from June 1987. Containerboard production for domestic use was up 4.6%, but unbleached kraft linerboard exports through May were down 0.1%.

Canadian newsprint shipments totaled 851,000 metric tons in June, unchanged from a year earlier. Woodpulp exports totaled 699,000 tons, down a sharp 8.4% compared with June 1987. Operating rates through the first half were 96% at pulp mills and 99% at newsprint mills. ■

	Latest month	(000 short tons)	% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER AND PAPERBOARD					
Newsprint	June	490	–	5,977	4.5
Uncoated groundwood (s)	June	123	2.5	1,560	3.4
Coated paper (s)	June	599	5.3	7,382	11.2
Uncoated free sheet (s)	June	899	-1.7	11,298	5.8
Other printing/writing	June	115	5.5	1,508	9.6
Total packaging and other paper (s)	June	421	3.4	5,215	2.1
Tissue	June	450	2.5	5,427	3.7
Total paper	**June**	**3,096**	**1.6**	**38,368**	**5.6**
Unbleached kraft paperboard	June	1,583	0.6	19,346	4.7
Semichemical medium	June	466	–	5,677	1.4
Bleached paperboard	June	366	5.5	4,447	0.4
Recycled paperboard	June	734	4.0	8,964	6.1
Total paperboard	**June**	**3,150**	**1.9**	**38,434**	**3.9**
Total U.S. paper and paperboard output	**June**	**6,246**	**1.7**	**76,802**	**4.7**
WOODPULP AND WASTEPAPER					
Total U.S. woodpulp production	May	4,991	1.9	60,980	3.9
Market pulp production	May	642	0.8	8,286	6.2
Wastepaper consumption at paper/board mills	May	1,611	7.4	18,951	9.3
Pulpwood consumption (cords)	May	7,650	-0.9	96,005	2.8
CONTAINERBOARD AND BOXES					
Corrugated box shipments (billion ft²)	June	25.830	1.3	153.686[6]	4.4
Containerboard inventories at U.S. box plants and mills	June 1	2,595	8.9		
FOREIGN TRADE					
U.S. paper imports (including products)	May	1,095	6.9	12,905	4.1
Imports of Canadian newsprint	May	741	0.5	8,633[5]	-0.6
U.S. paper exports (including products)	May	452	12.4	5,835	16.8
Exports of unbleached kraft linerboard	May	160	-2.4	2,171	-0.1
Exports of woodpulp	May	433	14.9	5,306	15.4
Norscan pulp inventories[4]	June 30	670	-15.7		
Norscan pulp operating rates[4]	June	96%	90%	95%	98%
NEWSPRINT					
Total newsprint shipments	June	851	-0.7	4,874[6]	0.7
Operating rates	June	97%	97%	99%	98%
Inventories held by U.S. consumers	June 30	1,539	9.5		
Other paper/board shipments	June	568	8.4	3,368	6.4
Woodpulp shipments (export only)	June	699	-8.4	4,013	0.9
Operating rates	June	99%	99%	96%	97%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fibre Box Assn., Paperboard Packaging Council. 4. North American/Scandinavian paper-grade market pulp. 5. Canadian Pulp & Paper Assn. 6. Not annualized. (s) = Shipments.

Uncoated groundwood: Markets tighten, prices continue to rise in virtually all segments

Grade structure: Uncoated groundwood papers are essentially value-added newsprint in that their physical properties have been enhanced by superior brightness and smoothness. Supercalendering (SC) adds a glossy finish that allows higher-quality papers to compete with lightweight coated (LWC) groundwood papers. Brightness levels range from 64 to 74 Elrepho, compared with 56 to 62 for standard newsprint. Major end uses include Sunday newspaper magazines, preprinted newspaper inserts and direct mail flyers, catalogs, telephone directories, and business forms. Basis weights range from 20 to 45 lb/3,300 ft².

Production/capacity: North American production of groundwood papers continued on an upward trend as some mills converted newsprint machines to groundwood specialties. Shipments by U.S. mills actually dropped to less than 1.5 million short tons in 1987, or 3.2% less than 1986. Canadian shipments, on the other hand, rose 9.8% to 1.338 million metric tons (1.475 million short tons). Most of that paper headed south.

Capacity in Canada and the U.S. is rising. This includes conversions such as Abitibi-Price Inc.'s mills in Alma (directory paper) and Jonquière (SC-grade A/web-size offset paper), Que., and new capacity at mills such as Lake Superior Paper Industries Inc. (SC) in Duluth, Minn. Canadian capacity will rise to about 14.6% from 1988 to 1989, while in the U.S. the increase will be just 0.9% to 1.882 million tons.

New capacity includes the following: Consolidated-Bathurst Inc., Grand'Mère, Que., (110,000 short-tpy net, 1989); St. Marys Paper Inc., Sault Ste. Marie, Ont., (125,000 short-tpy net, 1988); and F.F. Soucy Inc., Rivière-du-Loup, Que., (22,000 short tpy, rebuild, 1989). St-Raymond Paper Ltd. is adding incremental directory paper capacity at St-Raymond, Que., this year and has brought online all 70,000 tpy at the former Pejepscot mill in Maine. Daishowa America has proposed a new 150,000-tpy directory paper machine in Port Angeles, Wash.

Some overcapacity may occur in 1989 and 1990. A mild recession in late 1989 and 1990 and better availability of newsprint and LWC will be the causes. North American demand for uncoated groundwood paper will grow 500,000 short tons by 1990, yet capacity will increase 934,000 short tons.

Outlook: Fairly stable growth rates of 5%/year are expected for the next several years in major end-use markets for uncoated groundwood.

Directory paper will grow at an average 3.6% annually through 2000 at the seven regional Bell operating companies (RBOCs). This growth is slower than the high single-digit or low double-digit rates experienced by the independent publishers, who use from 15% to 20% of the tonnage.

Analysts say SC paper will account for about 16% of the catalog paper market by 1995, up from 4% in 1986. Some of that growth will come at the expense of machine-finished grades as well as from general growth in catalogs.

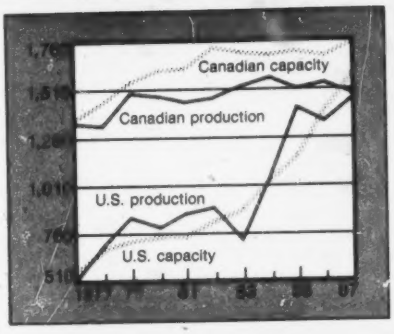
Office electronics are creating opportunities for groundwood producers who manufacture basestocks for computer forms. The number of small, inexpensive computer printers is expected to grow rapidly.

Preprinted advertising inserts grew at a compound annual growth rate of 14% from 1970 to 1986. Growth may be as high as 12% in 1988 and 8%/year for the longer term.

Prices: Prices on all grades have been rising, pushed up from the bottom by newsprint and pulled from the top by LWC.

List prices for 34-lb supercalendered ($/short ton) are: 1986, $735; 1987, $704; midyear 1988, $780. Prices for 35-lb offset, 65 brightness forms: 1986, $537; 1987, $565; midyear 1988, $660. For standard 30-lb rotonews: 1986, $493; 1987, $541; midyear 1988, $647. For 15-lb, 65 brightness forms: 1986, $520; 1987, $560; midyear 1988, $695.

SUPPLY/DEMAND (000 tons)



FORECAST (000 tons)

U.S.	1986	1987	1988e
Production[1]	1,540	1,491	1,613
Capacity[1]	1,685	1,756	1,865
Utilization rate	91.4	84.9	86.5
Imports	1,028	1,270	1,602
Exports	41	56	51
Apparent U.S. consumption	2,527	2,705	3,164
lb/capita	20.98	22.26	25.80
GNP ratio[1]	0.68	0.71	
Canada			
Production[2]	1,343	1,475	1,683
Capacity[2]	1,391	1,598	1,772
Utilization rate	96.5	92.3	94.9
Exports	1,138	1,253	1,382

e = Estimate.
1. American Paper Institute.
2. Canadian Pulp & Paper Assn.

TOP U.S. PRODUCERS (000 tpy)

	Annual capacity		Market share	
	U.S.	Canada	Total	(%)
1. Abitibi-Price	—	440	440	9.6
2. MacBlo	—	435	435	9.5
3. CIP	—	425	425	9.3
4. ConBath	—	380	380	8.3
5. Boise Cascade	—	325	325	7.1
6. GN Nekoosa[1]	303	—	303	6.6
7. Champion[2]	275	—	275	6.0
8. Domtar	—	190	190	4.1
9. Kimberly-Clark	131	41	172	3.8
10. Madison	165	—	165	3.6

Capacity share of top five companies: **43.8%**

Capacity share of top ten companies: **67.9%**

North American capacity (1988): **4.580e**

U.S.: **1. 865** Canada: **2.715**[3] **million short tons**

e = *P&P* estimate.
1. Millinocket, Maine, mill.
2. 1987 production.
3. Canadian Pulp & Paper Assn. estimates 1988 capacity at 1.644 million tons; does not include rotonews and some other groundwood capacity.

SALES & EARNINGS

Second-quarter 1988 earnings surged 50.3%

U.S. pulp and paper companies rolled up a 50.3% jump in earnings for second-quarter 1988 on a 15.6% increase in sales, according to a *Pulp & Paper Week* survey of 29 companies. This follows a 60% jump in profits in the first quarter.

Although earnings growth appears to have been modest between the first and second quarters, several companies are predicting record profits for 1988. Many companies echoed the sentiments of Bowater Inc. chairman and CEO A.P. Gammie, who noted, "In contrast to all the uncertainties being heard about the rest of 1988 and 1989, our order books are full, the customers for our main products are enjoying good business conditions, and we expect 1988 to continue to be our best year so far."

International Paper Co. again led the U.S. industry profit parade. Chairman and CEO John A. Georges attributed the doubling in income to "continued strong demand for nearly all our products and the price increases we have realized on all our major product lines." He also singled out the performance of the nonwovens division, Fibertec, which the company acquired last year from Kendall. Georges said he is expecting steady, moderate improvement in earnings for the company for the rest of the year.

Weyerhaeuser Co. saw its profits jump 68.8% to $150 million. The excellent returns came despite extensive scheduled maintenance downtime at most mills and a three-week shutdown of its New Bern, N.C., market pulp mill following the accidental rupture of a bleaching tank. Income from these operations will be "significantly higher" in the rest of the year, chairman and CEO George H. Weyerhaeuser predicted. Weyerhaeuser expects the performance of the company's forest products operations in the third quarter to be somewhat improved over a year earlier.

Georgia-Pacific Corp. had the most sales of any company surveyed at $2.42 million. T. Marshall Hahn Jr., chairman and CEO, said that operating profits for the company's pulp and paper business set a new second-quarter record at $133 million (prior to a one-time gain in 1987). Georgia-Pacific benefited from strong demand both at home and abroad for pulp and linerboard as well as from good domestic demand for uncoated free-sheet. "We expect demand for these products to remain healthy during the second half as Georgia-Pacific completes significant capacity expansions at our Monticello, Miss., and Port Hudson, La., pulp and paper mills and as we finalize our acquisition of Brunswick Pulp & Paper Co.," Hahn said. Profits from the building products segment declined 16.6% from the year-earlier period because of the effects that interest rates are having on housing starts.

James River Corp. completed its fiscal year in April with record earnings of $209 million—a 23% increase over the prior year. The company's fourth-quarter profits were up 28.9%, largely due to the performance of the printing/writing papers, specialty papers, and paperboard packaging busi-

U.S. paper industry results.

Companies	Sales	Second quarter ($000) Change 1988/87	Earnings[1]	Change 1988/87
Boise Cascade Corp.	$1,007,180	7.6%	$72,230	105.0%
Bowater Inc.	351,627	18.4	40,802	143.6
Champion International[2]	1,262,373	8.7	112,193[2]	67.1
Chesapeake Corp.	184,723	5.5	11,927	67.1
Consolidated Papers	221,731	25.0	39,013	104.0
Federal Paper Board[2]	248,222	3.0	28,847[2]	71.8
Fort Howard Corp.	503,162	6.5	46,912	−3.8
Gaylord Container Corp.	188,200	46.2	12,400	85.1
Georgia-Pacific Corp.[2]	2,418,000	15.4	118,000[2]	−20.3
P.H. Glatfelter Co.	143,437	40.3	21,002	47.9
GN Nekoosa Corp.	856,900	49.0	85,300	90.0
International Paper Co.	2,400,000	26.3	188,000	108.9
James River Corp.	1,394,885	17.1	59,056	28.9
Jefferson Smurfit Corp.	321,864	19.0	36,673	83.9
Kimberly-Clark Corp.	1,340,700	9.5	100,100	19.5
Longview Fibre Co.	169,733	20.6	29,411	90.9
Louisiana-Pacific Corp.[2]	474,200	13.5	39,000[2]	18.2
Mead Corp.	1,159,900	7.6	73,000	40.7
Pentair Inc.	203,912	3.9	9,862	234.8
Pope & Talbot Inc.	121,955	14.7	6,859	−4.9
Potlatch Corp.	266,758	9.4	24,538	10.0
Scott Paper Co.	1,164,100	13.1	75,300	28.1
Sonoco Products Co.	418,669	22.3	46,260	42.5
Stone Container Corp.	858,700	3.3	78,100	140.3
Temple-Inland Inc.	448,500	13.5	53,100	48.3
Union Camp Corp.	660,076	11.8	74,080	54.9
Wausau Paper Mills Co.	74,297	16.5	4,570	57.5
Westvaco Corp. (4/30)	533,313	15.6	45,219	86.1
Weyerhaeuser Co.	2,094,656	18.4	150,569	68.8
Willamette Industries	424,583	20.5	42,318	52.4
Total	**$21,916,353**	**15.6%**	**$1,704,841**	**50.3%**

1. Income after taxes from continuing operations, excluding most significant nonrecurring items after taxes in both years when possible.
2. **Champion International:** 1987 quarter excludes pretax gains relating to the sale of the company's investments in Stone Container Corp. and U.S. Plywood Corp. and adjustment of a reserve. **Federal Paper Board Co.:** 1987 second-quarter earnings excludes $8.2-million charge from premium on retirement of debt. **Georgia-Pacific Corp.:** 1987 second-quarter earnings include pretax gain of $60 million from liquidation of investments. **Louisiana-Pacific:** Results have been restated to show Fibreboard Corp. as a discontinued operation.

nesses. Its towel and tissue earnings were depressed due to higher costs (mostly pulp) that had not yet been recovered through recent price increases. The company's flexible packaging business reported significantly lower earnings because of the rapidly escalating costs of styrene.

Full order books. Champion International Corp. recorded a 67% increase in earnings and is looking forward to a profitable third quarter thanks to the July 1 price increase on all coated and some uncoated grades. Newsprint earnings increased modestly from the first-quarter level. The July 1 price increase on market pulp will also help Champion, which sells about 250,000 tpy of pulp.

Mead Corp. enjoyed record sales and earnings for the second quarter and for the first half of 1988. The company reported strong order backlogs for its publication papers as well as new orders for its coated board, containerboard, pulp, and electronic publishing segments.

Consolidated Papers Inc. doubled its profits in the second quarter of 1988. Consolidated Papers' four paper mills operated at capacity, shipments increased, and prices were restored to 1985 levels.

Boise Cascade Corp. more than doubled its earnings. The company is expecting a record year in 1988 despite the ongoing strike by sawmill workers at 15 of the company's 28 wood products plants and softer markets for wood products.

A containerboard bonanza. Stone Container Corp. predicted earnings more than doubled to between $76 and $80 million. The company raised linerboard and box prices last spring, and cost reductions and productivity improvement also accounted for the big boost in earnings.

Jefferson Smurfit Corp. enjoyed an 84% increase in earnings—a new record high for the tenth consecutive quarter. Earnings in the first half of 1988 were 551% above those of first-half 1986, thanks to an improved operating environment and the acquisition of Container Corp. of America and an 80% stake in Publishers Paper. Smurfit is looking forward to reaping the benefits of a third-quarter price increase on solid bleached sulfate (SBS) and recycled boxboard. Smurfit said 10 of its 18 paper mills have set production records so far this year.

Federal Paper Board Co. Inc. saw profits rise 72%, setting a new record. The company expects to have record profits this year. A new recovery boiler at the Augusta, Ga., mill should help earnings gains in the next quarter. Gaylord Container Corp., which recently went public, saw its profits rise 85% in its first quarter.

Tissue results mixed. Scott Paper Co. enjoyed record profits for any quarter in its history. Scott's personal care business in the U.S. achieved record unit sales volumes as well as a 16% increase in income. Sales and income from S.D. Warren Co.'s printing and publishing papers business increased 11% and 34%, respectively, setting a second-quarter record.

Fort Howard Corp.'s profits were down 3.8%. The company said expenses relating to the pending buyout of the company reduced income by about $2.68 million (4¢/share). Profits were reduced by a similar amount by the strike at its Canadian cup manufacturing operations. High resin costs also limited profits. (Kimberly-Clark Corp.'s results were not available.)

Pope & Talbot Inc. was one of the few companies to show a decline in profits, and this occurred because of the 45-day strike at the company's Halsey, Ore., market pulp mill. Despite the strike, profits almost hit the record level set in 1987. ■

Canadian second-quarter earnings rose 27.6%

Canadian forest products companies enjoyed a 27.6% increase in profits on a 6.9% increase in sales during the second quarter. Canadian producers are still grappling with the strong Canadian dollar, which is cutting into the profits they can make in Europe and their biggest market—the U.S. Since the British Columbian pulp and paper mills managed to conclude labor negotiations without a strike, they will continue to profit from tight pulp markets in the third quarter. The slowdown in housing construction in North America curtailed demand for lumber in the quarter. Newsprint producers are still making money but not as much as they thought they would when the year started.

Canada saw two big mergers in the second quarter: CIP Inc. and Great Lakes Forest Products Ltd. are now doing business as Canadian Pacific Forest Products Ltd., and Crown Forest Industries Ltd. and British Columbia Forest Products Ltd. will operate as Fletcher Challenge Canada Ltd.

Canadian paper industry results.

	Second-quarter 1988 (C$000)			
Companies	Sales	Change 1988/87	Earnings[1]	Change 1988/87
Abitibi-Price Inc.	$835,500	10.5%	$54,400	50.3%
B.C. Forest Products	393,300	14.3	48,900	50.9
Canadian Pacific[2]	753,500	8.5	74,300[2]	48.3
Canfor Corp.[2]	279,500	−11.1	29,600	11.3
Cascades Inc.[2]	148,615	9.9	10,462[2]	−28.3
Consolidated-Bathurst	609,000	6.2	59,900	38.3
Domtar Inc.	646,000	−1.7	24,000	−45.5
Donohue Inc.	161,200	21.1	18,300	83.0
MacMillan Bloedel Ltd.	851,500	5.5	94,500	26.7
Noranda Forest Inc.	1,181,000	7.2	71,000	31.5
Repap Enterprises Inc.	249,100	5.2	21,300	54.3
Rolland Inc.	109,800	13.2	842	−19.9
Scott Paper Ltd.	79,868	5.9	4,246	15.9
Weldwood of Canada	237,484	25.0	20,256	77.5
West Fraser Timber	123,400	10.8	13,700	15.1
Total	**$6,888,767**	**6.9%**	**$545,706**	**27.6%**

1. Income after taxes from continuing operations, excluding significant nonrecurring items in both years when possible.
2. **Canadian Pacific Forest Products Ltd.:** results include those of Great Lakes Forest Products Ltd. and CIP Inc., which merged to form Canadian Pacific second-quarter 1988. **Canfor:** 1988 quarter excludes extraordinary gain of C$68.5 million from sale of assets to Howe Sound Pulp & Paper. **Cascades:** 1987 quarter includes C$7.0 million credit from tax-loss carry-forward.

Federal signs letter of intent to sell mill

Federal Paper Board Co. announced that it has signed a letter of intent to sell its 35-tpd Los Angeles, Calif., recycled boxboard mill and cogeneration facility to separate buyers, who were not identified. Federal has been seeking a buyer for the Los Angeles mill since November of last year, when it also put the 230-tpd Richmond, Va., recycled boxboard mill on the selling block. The Richmond mill was sold to Sonoco Products Co. in February.

Federal has also closed carton plants in Elkhart, Ind., and Los Angeles as part of its reduced emphasis on the recycled paperboard business, which has shown poor profitability in recent years. The thrust of the company's boxboard business is now focused on two solid bleached paperboard mills in Augusta, Ga., and Riegelwood, N.C., and a high-quality cylinderboard mill in Sprague, Conn.

Indicative of this new direction are the company's expansion programs at the solid bleached sulfate (SBS) mills and the acquisition in June of United Paper Inc., a bleached paperboard converter with sheeting operations in Sturgis, Mich., and Ontario, Calif.

Federal will retain the Sprague mill and has initiated a capital improvement program there that is expected to boost capacity from the current 500 tpd to 600 tpd over the next two years. The mill's twin-wire Inverform cylinderboard machine is one of the most efficient and productive machines of its kind in the industry, says Federal's president and CEO, John R. Kennedy.

The machine produces a clay-coated five-ply board using a furnish of old corrugated containers (OCC) and deinked newsprint. Federal is initially upgrading the stock cleaning system at the mill with the installation of five new Ultra screens supplied by Black Clawson. ■

World liner exports rose 5.4% from major suppliers

U.S. linerboard exports last year increased 5.4% to 2.29 million tons, second only to the record 2.5 million tons exported in 1980, according to the American Paper Institute's annual linerboard export report. "The very strong worldwide demand coupled with tight supply, plus the lower U.S. dollar, contributed to the sharp rise in the value of U.S. kraft linerboard exports—up 27.7% to a record $611.5 million," noted Irene Meister, API vice president-international.

U.S. linerboard producers again directed a greater portion of export shipments to Far East markets. Last year the Far East (including People's Rep. China) accounted for 40% of U.S. linerboard exports, up from less than 10% in 1977. Exports to western Europe declined to 26% in 1987 from 29.2% in 1986. This is down from 40% about ten years ago and more than 50% in the early 1970s.

The increase in U.S. export shipments last year matched total shipments by nine major supplying countries, which rose 5.4% to 4.67 million tons (see table).

European market strong. Western Europe linerboard demand remained strong in 1987, helped by an increase of approximately 6% in corrugated box shipments. Last year, western European imports from nine major supplying countries rose by 4.5% to 2.6 million short tons.

U.S. linerboard shipments to western Europe declined by 6.2% to 596,650 tons, their second-lowest level in the past dozen years. However, Nordic suppliers plus Brazil strengthened their position in the European market. Shipments from Sweden rose by 7.7% to 1.1 million tons and from Finland by 12.2% to 253,550 compared with 1986. Brazil increased its shipments to Europe by 19.5% to 186,270 tons. Shipments from Portugal, however, declined 15% to 121,180 tons. (The figures for western Europe do not include imports from France, South Africa, and the U.S.S.R., which in 1986 exceeded 270,000 tons).

Further testliner inroads? While final European linerboard consumption statistics are not yet available, Dr. Meister said it was possible to draw some preliminary conclusions based on the high level of corrugated box shipments and a stable inventory situation. "The testliner share of the linerboard market probably increased somewhat last year as local testliner producers continued to enjoy a competitive advantage because of extremely low wastepaper prices and rising prices for kraft linerboard due to the tight supply/demand situation," she noted.

Nordic shipments of bleached linerboard grades, mainly to western Europe, were strong. Sweden's total bleached exports jumped 15.9% to 197,800 tons, while Finland's rose 30.1% to 93,840 tons (reflecting rebuild of a machine to make white-top board). Finland continued to be the world's largest corrugating medium exporter, with total shipments of 345,270 tons in 1987, up 7.6%.

U.S. linerboard shipments to Japan of 167,000 tons remained unchanged from the previous year, while imports from Canada dropped 20% to 40,000 tons. Japanese production of domestic linerboard (including the wastepaper-containing grades) was strong—up 16% to 4.6 million tons, according to Japan Paper Assn. statistics.

Copies of the twenty-fourth edition of Exports of Kraft Linerboard and Corrugating Material from Major Supply Countries to World Markets *are available for $100 ($105 foreign) from API's International Dept., 260 Madison Ave., New York, N.Y. 10016.*

Kraft linerboard exports by major supplying countries to world markets (000 short tons).

	1987	1986	1985	% change 1987/86
U.S.	2,295	2,177	1,807	5.4%
Sweden	1,190	1,111	1,147	7.6
Canada	311	347	290	−10.4
Finland	284	244	282	16.4
Brazil	234	208	154	12.5
Portugal	128	149	151	−15.1
Austria	122	109	102	11.6
Norway	55	42	20	30.9
Japan	43	39	39	11.0
Total	4,666	4,426	3,972	5.4

Source: American Paper Institute—International Div.

Sulfite segments are up and down; chemicals cost more

A split exists among the sulfite-based pulp manufacturers as production falls for paper-grade chemical pulp but rises steadily for neutral sulfite semichemical (NSSC) and sulfur-free products. Chemicals supporting the processes are climbing despite the uneven production, as sustained demand and tighter supply for the major end-user markets continue through the close of this decade.

Sulfite pulping in the U.S. and Canada continues to decline, evident again during 1987 as two mills closed (Procter & Gamble, Ontario Paper) and others were completely dismantled. Thirty-four mills using the acid sulfite process remain, although their size and environmental vulnerabilities may dictate a few more closures during the 1990s. Many have made progress through modernization (e.g., switching mediums to accommodate chemical recovery, upgrading bleach plants to ease effluent loads, utilizing computers, and reaching and obtaining specialty grade market niches), and these mills should be strong. Capacity in North America stands at 9,000 tpd, and growth estimates are flat or negative.

Bisulfite mills are newer and more efficient. North America produces 3,300 tpd (of which the U.S. has two-thirds), and many larger locations are mainly integrated or adjacent to consumers.

Chemical suppliers for acid and bisulfite have treated the industry as a small player but have driven up prices along with the other industries who are experiencing the same economic boom. Elemental sulfur production rose less than 1%, as Frasch production fell sharply and recovered sulfur production jumped high enough to register an increase. Imports are growing and exports declining. This is a strong indication of the supply crunch across North America and the greater role to be played by the Saudis and Balkans. Sulfur dioxide shipments to the pulp industry increased but can be attributed to the demand for it in chemical pulp bleaching (as an antichlor and in chlorine dioxide generators). Liquids are the choice of many modern burners purchased by some Canadian mills, as bigger models and recovery loops work better with site-ready products and minimal makedown.

NSSC, sulfur-free, and green liquor processes are growing along with the indust[illegible]cle. Semichemical board achiev[illegible] 5% increase in production last year, and it will probably reach 5.7 million tons in 1988. There is some new capacity, including expansions at Stone Container in Uncasville, Conn., and Corrugated Services in Forney, Texas, and restarts for Clinch River at Harriman, Tenn., ISC, CCA at Fernandina Beach, Fla., and Cascades at Niagara Falls, N.Y. Industry pundits are watching inventories of big-ticket items and nondefense durables as the key trend indicators.

PRICE. Chemicals used to produce these pulps have done well. Mills are still using traditional amounts of soda ash and sulfite compounds (6% to 8% and 10% to 14%, respectively) without other substitutes. Soda ash production will rise 10% over last year's level, and the forced price hike seen last year remains firm. Sulfur prices have recently been boosted, and producers and forecasters alike predict another upward move soon.

The price of caustic presents a double challenge to the industry. First, the tremendous consumption growth of sodium sulfite from the site-ready users and the new bleached chemi-thermomechanical pulp (BCTMP) mills have fueled demand and made utilization full. But caustic is used in processing, and its rising cost is now being transferred in part to the consumers. This same situation makes soda ash (and technologies to produce caustic on site) more attractive to all chemical pulpers, as each increase in caustic price gives new life to opportunities to switch to sodium carbonate products.

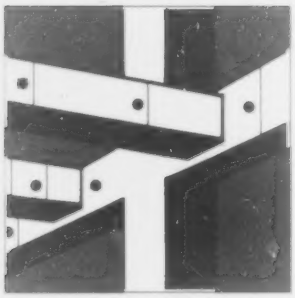
—*Michael Ducey*

Consumption rises and prices lag but follow trend.

Chemical	Pulp industry consumption, 1987 (short tons)	% change, 1987	Price[1]	% change, 1987
Sodium sulfite	134,00	16.7	$0.22/lb	10-15
Sodium carbonate	840,000	7.3	$80/ton	5
Sulfur[2]	56,600	3.2	$120/ton $94/ton	8

1. Prices courtesy of *Chemical Marketing Reporter*.
2. Sulfur prices are for southern and western freight on board shipments, respectively.

Correction. The July 1988 column on chemical pulp bleaching chemicals was in error. The information in the table should have read 4 billion pounds of chlorine consumed and 5.5 billion pounds of caustic consumed. The figures given represented the total production of each.



ENGINEERING: Assessment

ENGINEERS OPERATE AT FULL THROTTLE TO MEET INDUSTRY'S GROWTH DEMAND

With a record $11.5 billion in expansion money, and more seen for 1989, paper companies are taxing the ability of engineers to keep up

By KEN L. PATRICK, Editor in Chief

The North American paper industry has been on a spending spree for the past five years. Strong consumer demand has kept operating rates above 95% for many grades, and most companies have been churning unusually high profits back into their primary manufacturing operations. Currently, the volume of expansion/modernization work in the industry is taxing the ability of suppliers, particularly engineering firms, to keep up with demand. Equipment delays, rising costs, and a shortage of engineering manpower are becoming more common.

Since 1984, U.S. outlays for expansion/modernization projects have steadily increased, each year surprising analysts by setting yet another new record (Figure 1). At this time last September, capital spending in 1988 was expected to be 3% to 5% over 1987, somewhat of a turnaround from earlier projections (some were showing reduced spending). Certainly no one expected the 27% to 30% increase in capital spending that is currently being maintained. If estimations hold, the U.S. paper industry will spend some $11.5 billion by the end of this year.

The story is similar in Canada, where pulp and papermakers plan to spend a record C$1.23 billion on capital improvements this year, an increase of 31.8% over 1987. An additional $1.50 billion will go toward non-capitalized repair expenditures, 8.1% more than last year.

This pace of investment obviously is a reflection of the strength of the paper industry in North America, particularly in the U.S., where companies have prospered despite a recent loss of tax breaks, including the investment tax credit. Paper continues to outpace all other major U.S. industry segments in the size of its planned capital spending increase. U.S. manufacturers as a whole now plan to increase outlays by 12.1% in 1988.

The shortage and delay problems brought on by such a healthy expansion appetite, although certainly envied by many other industries—including the paper industry itself only a few years ago, could significantly restrain continued growth in the near future if they are not controlled. This issue of *Pulp & Paper* analyzes the current engineering "crunch" in detail, exploring some of the conditions that have caused it and examining various new approaches that could help lead to a more workable solution.

ENGINEERING CRUNCH. At a recent security analysts' meeting, Peter Norrie, senior vice president of Boise Cascade Corp., stated that "paper machine fabricators today will quote 26 to 28 months for delivery of a paper machine as opposed to 18 to 20 months a year ago." Equipment costs have also gone up 10% to 20% in the past year, according to Norrie. In addition, construction costs have been increasing in recent years, taking a sharp turn upward last year (Figure 2). Norrie pointed out that, making matters worse, there is currently a significant shortfall of engineers, especially at large engi-

neering companies that serve the paper industry.

Norrie estimated that these firms now have approximately 4,500 engineers and that they would need another 1,500 to handle all of the work in house. "Capacity expansions under way today will likely come on according to schedule," he noted. But the projects scheduled to begin in a year may be delayed slightly, and startup dates for those projects slated to begin in two years may be set back as much as a year due to a combination of equipment delays and engineering/construction backlogs.

The industry's previous growth cycle was in the late 1970s to early 1980s. During this period, engineering and construction staffing was at an all-time high. Most firms report current staff levels approaching that previous peak, possibly surpassing it early next year. In fact, the real crunch, particularly on the construction side, is expected to occur sometime next year, with most firms now booked solid through 1989.

Fluor Daniel at Greenville, S.C., for example, currently has close to 30,000 construction personnel, not yet up to the approximate 40,000 that were employed during the 1979-81 heyday. But by the end of this year, it expects possibly to be up to that level. Prior to the 1979-81 boom, the company was averaging about 15,000 construction workers.

On the engineering design side, BE&K Engineering Co.'s backlog is at an all-time high. Officials there report the most activity since mid-1960. Ted C. Kennedy, BE&K's chairman, points to the fact that considerable engineering talent was lost after the industry's early 1980s downturn, complicating the current search for experienced, competent engineers.

Other engineering construction companies serving the pulp and paper industry, such as CRS Sirrine Inc., Rust International Corp., Simons-Eastern Inc., Sandwell Swan Wooster Inc., and Ford, Bacon & Davis Inc., also report full slates. Some are having to decline proposals or take only a share of major projects due to limited engineering capacity.

None of these companies is involved exclusively in the paper industry. Some 70% of Rust's engineering business, for example, is in pulp and paper, but Fluor

FIGURE 1: **U.S. and Canadian paper companies continue to set new capital spending records; even more is planned for 1989.**

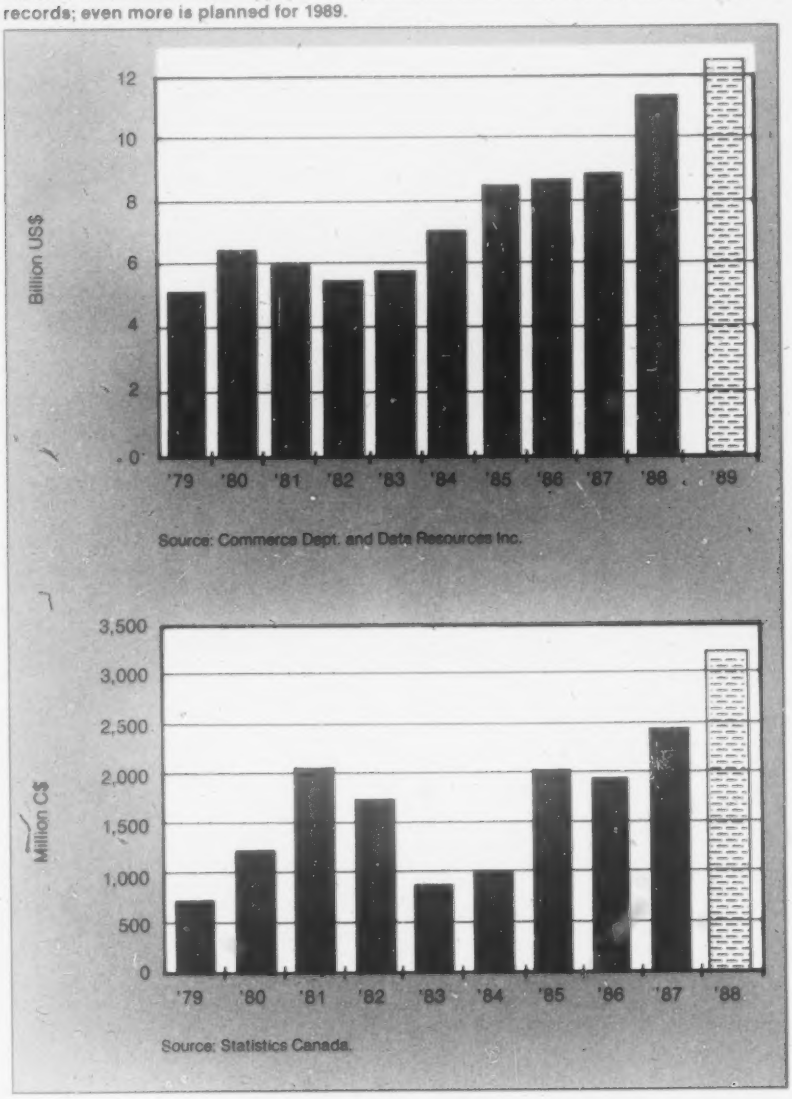


FIGURE 2: **Construction costs in the U.S. have escalated in recent years, particularly since 1987, when the paper industry was in the middle of its current growth period.**

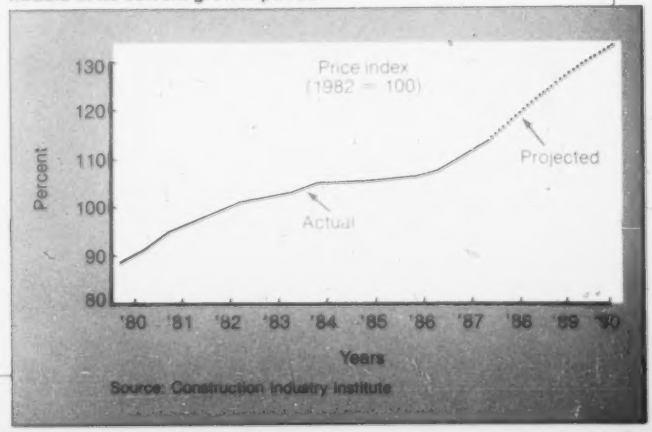


TABLE I Major U.S. paper industry capital spending projects, 1989-91.

Company	Project	Cost	Startup
Blandin Paper Co. Grand Rapids, Minn.	New LWC paper machine, coater, TMP upgrade	$334 million	1989
Boise Cascade Corp. International Falls, Minn.	New paper machine, upgrade pulp mill, woodyard	$539.5 million	1990
Boise Cascade Corp. Rumford, Maine	New coal/biomass cogeneration plant	$187 million	1990
Bowater Southern Paper Co. Calhoun, Tenn.	Pulp mill expansion	$205 million	1990
Champion International Corp. Bucksport, Maine	Paper machine rebuild, new coaters	$63 million	1989
Champion International Corp. Pensacola, Fla.	Further rebuild of No. 3 machine	NA	1989
Champion International Corp. Quinnesec, Mich.	New paper machine	NA	1990
Chesapeake Corp. Menasha, Wis.	New tissue machine	$148.9 million	1990
Daishowa America Port Angeles, Wash.	Modernize two machines	NA	1990
Federal Paper Board Co. Inc. Augusta, Ga.	New recovery boiler machine rebuild, pulp mill upgrade, others	$460 million	1988-91
Fort Howard Corp. Rincon, Ga.	Third tissue machine, new power boiler converting lines	$170 million	1989
Fraser Paper Ltd. Madawaska, Maine	Rebuild of two machines	$53.5 million	1989
Gaylord Container Corp. Bogalusa, La.	New linerboard machine, recovery boiler	$100 million	1990
Georgia-Pacific Corp. Woodland, Maine	New recovery boiler	$78 million	1989
Glatfelter Co. Spring Grove, Pa.	New cogeneration plant	$56 million	1989
Great Northern Nekoosa Corp. Ashdown, Ark.	New recovery boiler	$90 million	1989
Green Bay Packaging Inc. Green Bay, Wis.	Corrugating machine rebuild	NA	1990
Green Bay Packaging Green Bay, Wis.	New press section, pulp mill upgrade	NA	1990
International Paper Co. Vicksburg, Miss.	Upgrade linerboard machine, pulp mill	$50 million	1989
James River Corp. Camas, Wash.	Upgrade recovery boiler	$51 million	1990
Longview Fibre Co. Longvew, Wash.	New paper machine	$90 million	1990
Louisiana-Pacific Corp. Somoa, Calif.	Modernize pulp mill, bleach plant, recovery boiler, others	$102 million	1990
Newsprint South Grenada, Miss.	Greenfield newsprint mill	$320 million	1989
Ponderay Newsprint Usk, Wash.	Greenfield newsprint mill	$300 million	1989
Southeast Paper Mfg. Co. Dublin, Ga.	Second newsprint machine, new deinking and power plants	$300 million	1989
Stone Container Corp. Uncasville, Conn.	Paper machine, rebuild new generator	$24 million	1989
Temple-Inland Inc. Orange, Texas	Modernize two machines, recovery boiler, woodyard	$59 million	1989
Temple-Inland Inc. Rome, Ga.	Modernize two machines, new recovery boiler, mill upgrade	$170 million	1988-89
Union Camp Corp. Savannah, Ga.	New linerboard machine, major pulp mill upgrade	$375 million	1991
Westvaco Corp. Luke, Md.	Rebuild all five paper machines, new bleach line	$200 million	1990
Westvaco Corp. Wickliffe, Ky.	New coating facilities	$125 million	1990
Weyerhauser Paper Co. Columbus, Miss.	New pulp mill/bleach plant	NA	1990

Daniel is involved on a much smaller scale at 10% to 15% (although this amount is rapidly increasing). Somewhere in between would be companies such as CRS Sirrine at about 40%. The fact that these companies are additionally involved in other industries provides somewhat of a buffer against severe up and down cycles. Thus, experienced engineering staffs can be maintained to some degree if peak-and-valley projects are "cross-balanced." Many large consulting firms have been doing this as much as possible and plan to do so even more to prevent future engineering manpower crunches. A detailed discussion of the consulting firm's struggle to meet current industry demands begins on p. 76 of this issue.

Engineering firms are selectively acquiring experienced engineers from several sources, including other industries (petroleum, chemicals, textiles, etc.) as well as directly from the paper industry itself (mills, corporate and divisional engineering ranks, etc.). Although engineering expertise is transferable across industries to a certain degree, the engineer with specific pulp and paper process training and experience is particularly valuable at this time.

Thus, consulting firms are looking more at the industry itself as a supply house for potential employees, offering some very attractive salary and benefit incentives. In addition, an increasing number of engineering graduates from pulp and paper schools are accepting jobs with consulting firms as well as supplier companies, creating tremendous pressure on the schools to expand their programs and recruit more qualified students. However, this is not an objective that is easily accomplished. While most paper schools have stepped up their recruiting efforts, the number of students entering their programs has declined because of a combination of reasons, including not least of all a negative image of the paper industry. The current situation at U.S. pulp and paper schools is discussed in an article that begins on p. 210.

MAJOR INDUSTRY CAPITAL SPENDING PROJECTS. Table 1 lists most of the U.S. paper industry's major projects that are scheduled at this time for 1989-90. With engineering and construction companies already operating at or near capacity, this abundance of new projects obviously will serve to tighten the crunch beginning next year.

Not included in this list are the many projects that have come online or are scheduled to start up in 1988, including such major expansion projects as Georgia-Pacific Corp.'s new $100-million uncoated free-sheet machine at Zachary, La., James River Corp.'s new $88-million tissue machine at Clatskanie, Ore., and Potlatch Corp.'s new $75-million coated free-sheet machine at Cloquet, Minn.

The list does not include projects below approximately $20 million. Also not listed are major projects in Canada, such as Consolidated-Bathurst Inc.'s new $280-million groundwood specialties machine to start up in 1990 at Grand'Mère, Que., Finlay Forest Industries Ltd.'s $165-million project to integrate its Mackenzie, B.C., refiner-mechanical pulp (RMP) mill with a new 600-tpd newsprint machine (to start up early next year), and Great Lakes Forest Products Ltd.'s new 240,000-tpy newsprint machine at Thunder Bay, to cost some $217 million.

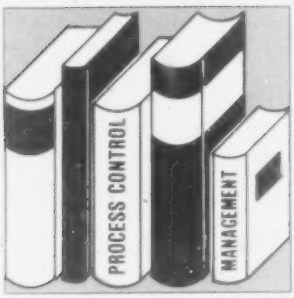
Table 2 shows major spenders in the U.S. This list includes companies with planned 1988 capital expenditures of $50 million and above. ■

TABLE 2. **U.S. capital spending by company, 1988-91.**

Boise Cascade Corp.	$794,000,000
Union Camp Corp.	$560,000,000
Federal Paper Board Co. Inc.	$498,000,000
Georgia-Pacific Corp.	$433,000,000
Fort Howard Paper Co.	$360,000,000
Temple Paper Co.	$344,000,000
Westvaco Corp.	$325,000,000
[illegible] Paper Corp.	$305,200,000
[illegible] Paper Manufacturing Co.	$300,000,000
[illegible] Paper Corp.	$260,000,000
[illegible] Inc.	$242,[illegible]5,000
[illegible] Ltd.	$205,[illegible]1,000
[illegible] Co.	$190,0[illegible],000
[illegible] Kalamazoo Corp.	$182,100,000
[illegible] Corp.	$148,900,000
[illegible] Co.	$147,000,000
[illegible] Co.	$141,900,000
[illegible] Paper Group Corp.	$139,900,000
[illegible] Paper Co.	$134,200,000
[illegible] Forest Inc.	$133,100,000
[illegible] Forest Corp.	$102,000,000
[illegible] Container Corp.	$100,000,000
[illegible] Resort Corp.	$91,500,000
[illegible] Container Corp.	$83,700,000
[illegible] Paper Ltd.	$73,600,000
Wausau Paper Mills Co.	$64,900,000
Glatfelter Co.	$58,000,000
Weyerhaeuser Paper Co.	$61,000,000

TABLE 3. **A consulting engineer's view of potential revenues and engineering manpower needed to handle paper industry capital projects through 1991. If 1989 (and beyond) spending is higher than figures shown, "engineers needed" would probably also be higher, extending the shortfall possibly through 1990.**

	Capital spending (billion $)	Potential output* ($ (billion $)	Engineers needed	Engineers available	Excess (+) shortage (−)
1986	8	360	4,500	4,500	0
1987	8.5	380	4,750	4,500	− 250
1988	11.25	510	6,400	4,750	−1,650
1989	10	450	5,600	5,000	− 600
1990	9.5	430	5,000	5,000	0
1991	9.5	430	4,750	5,000	+ 250



ENGINEERING: Staffing/Training

MEDIAN INCOME HITS $53,000 IN 1988, ACCORDING TO FOURTH SALARY SURVEY

P&P's May 1988 survey results show engineers gaining ground since 1984; top earners are still administrators, consultants, and salespeople

By KELLY H. FERGUSON, Projects Editor

This is *Pulp & Paper*'s fourth salary and opinion survey. Data from 1988 are compared with data from our 1984 survey to provide readers perspective on significant changes in compensation, benefits, and employee attitudes. The 1984 survey was selected because capital spending within the industry has been at record levels each year since that time.

The following report is based on responses to a questionnaire included in the May 1988 issue (p. 72). Information from the returned forms was processed by an independent data processing firm according to *Pulp & Paper*'s specifications. The number of responses were similar to previous years.

Basically, the report is designed to compare the progress of engineers in the paper industry, on the supplier and consulting side as well as in primary manufacturing, with professional peers in various other disciplines. In addition, the report also compares the salaries of specific engineering types and functions within the paper industry.

In general, the study indicates that engineers are gaining some ground in the compensation battle, a reflection of the increased value placed on engineering as capital expansion/modernization projects continue to stack up on drawing boards. Throughout this year, and particularly in 1989, the value of engineers is expected to increase even more as the "engineering crunch" continues to develop.

DATA ANALYSIS. The median income of respondents rose approximately 20% to $53,000 from 1984 to 1988, an average increase of some 4.7%/year. The median income of all respondents in 1984 was $44,000. Companies have grown, with 38.8% having annual sales of more than $2 billion in 1988, compared with 33.9% in 1984. Also, a majority (90%) said they liked their job, compared with 88.6% in 1984.

Similar to the profile in the 1984 survey, the average respondent is male (95.9%), lives in the Southeast (37%) or the Midwest (23.5%), works for a wood products/pulp and paper manufacturer (68%) in either production/mill operations (19.2%), technical service/quality control (13.7%), engineering design (13%), or engineering/maintenance (11.2%). Chemical engineers make up a larger percentage of bachelor degrees in the industry in 1988 (18.9%) than in 1984 (14.4%). Other degree distributions include: business (16.5%), paper science and technology (16%), and mechanical engineering (13.8%).

Job stability declined 4% during the four years, with 18% having changed employers in the last three years, compared with 12% in 1984. Other statistics include:

Compensation

- An average of two salary increases in the past three years.
- The last pay increase was 6%.
- Ten paid holidays and three weeks of vacation are taken yearly.
- 92.6% receive annual salary reviews based on merit performance (56%), cost-of-living index (3.3%), or both (26.8%).

Reader opinions

Pulp & Paper's fourth salary survey asked readers for comments on any subjects related specifically to their jobs or companies and the industry in general. Opinions focused primarily on three areas—mergers/acquisitions and restructuring, problems with salary, and problems with management. Comments have not been edited for content (only grammar and style as necessary) in order to retain their originality. The following were selected as typical of the many responses received.

"Salary is a major problem in the paper industry, especially where high growth in the last two years has not translated to higher raises for employees."
—salesman/Southeast

"Salaried professionals are underpaid in the paper industry compared with the union labor force."
—mechanical engineer/Southeast

"I [am employed by] a process control company that sells to the pulp and paper industry. I am changing jobs to work in a mill for a customer because it pays far more."
—engineer/Northeast

"I love the business and hope to stay with it until [retirement]."
—administrator/Southeast

"For the job I perform, I am definitely underpaid."
—market pulp purchaser/Southeast

"Lincoln was supposed to have freed the slaves. Southern companies are the cheapest to work for."
—production supervisor/Midwest

"The new team concept does work and is more [productive] for the lower number of employees."
—production worker/Midwest

"I'm a [type of] shift superintendent and am satisfied with my position. I've lived here for 36 years and have seen too many upper-management people [move in and out]. I don't ever want to have to relocate."
—production supervisor/Southwest

"[Pay will] start to apply for line supervision in the paper industry [has] to be brought up to that of other [industries]."
—maintenance supervisor/West

"[Our] management does not understand [marketing] and lacks a clear strategy."
—mechanical engineer/Midwest

"Employer cost sharing of medical insurance is costing me $3,000 a year vs only a $1,700 increase for my last raise—effectively only a 1.7% raise."
—civil engineer/Southeast

"Federal government employees work as hard, if not harder, than their industry counterparts but don't receive the same credit or compensation."
—consultant/Northeast

"I feel my company discriminates against women."
—production worker/Southeast

"Environmental issues must be faced more realistically, instead of reacting to governmental pushing."
—construction engineer/Southeast

"Short-term MBA attitude at corporate management level makes mill-level decisions very difficult. It's always changing, with no commitment to long-term planning."
—project engineer/Northeast

"My company has a policy of hiring for promotions from outside company ranks. This is demoralizing to employees."

—engineer/Southeast

"I have found it's not what you know, but who. Sad. Very sad."

—production worker/Northeast

"Many corporations are not making the effort, or are expending insufficient effort, to keep their technical people technologically current, and they do not provide the time or means to continue education. In addition, they are not laying down career paths with those individuals."

—technical service supervisor/Midwest

"Corporations are not developing young talent. There doesn't seem to be much interest in career planning."

—chemical engineer/Northeast

"Engineering and maintenance are being neglected by the new and young management. It is going downhill fast."

—mechanical engineer/Northwest

"My company is in a transition period, trying to change from an autocratic management style to a more progressive, employee-involvement style. Many managers, particularly my mill manager, are struggling with this new concept. We are a small mill run by one man—the mill manager. He insists people do what he wants, not what the other managers think—no team approach or concept."

—production worker/Northeast

"Morale at our facility is generally low due to upper-management decisions. The policies are very unclear, and very little technical evolution on an equal basis is carried out due to incompetent managers."

—researcher/Canada

"I was laid off in 1986 due to the present 'fad' of mergers. It took me one and a half years to secure a job again with the pulp and paper industry."

—timberland worker/Midwest

"My company does not take advantage of employee experience—it often makes foolish, expensive, avoidable mistakes. It is very insensitive to salaried employees."

—production worker/Northwest

"The majority of people working in this industry live in rural/remote areas, which brings down average salaries and [also] seriously affects the attitudes of managers in urban areas. I would like to change industries for this reason."

—project manager/Northeast

"Industry is leaning to accountants in upper-management jobs. I think technical personnel should have some of those positions."

—mechanical engineer/Southeast

"I would leave tomorrow if I found something interesting."

—maintenance supervisor/Northeast

- 87.6% are not paid overtime.
- The average respondent has not had a promotion in the last three years.

Personal

- 99.6% of the respondents work full-time; 2% are self-employed.

FIGURE 1: **Income and professional experience.**

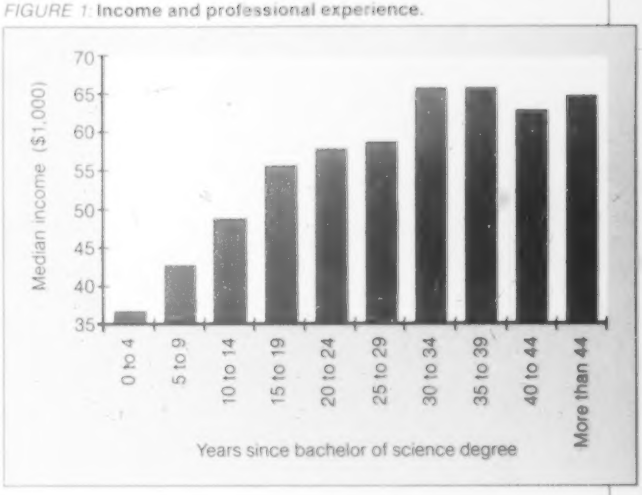


FIGURE 2: **Income and number of years with current employer, all respondents.**

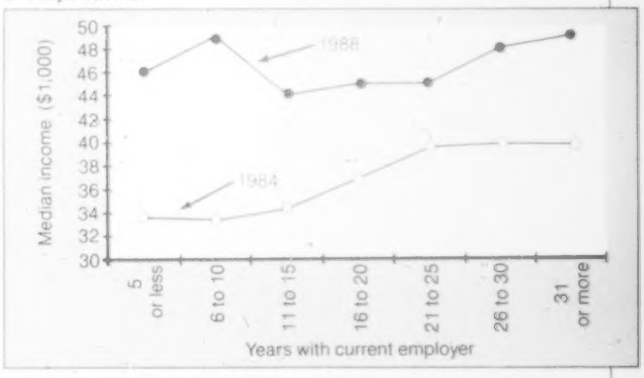
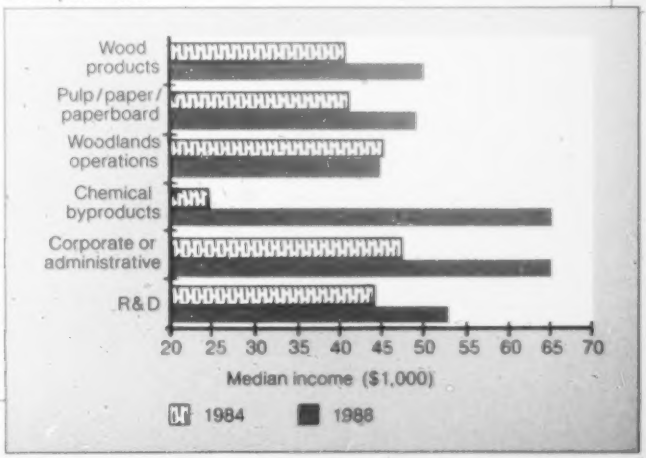


FIGURE 3: **Income and type of wood/pulp/paper company, all respondents.**



- Respondents work an hour more in 1988 (46) than they did in 1984 (45).
- 50.6% are more than 40 years of age, compared with 47.8% in 1984.
- The average respondent's work experience since leaving school is between 10 and 14 years.

FIGURE 4. **Income and number of employees managed, all respondents.**

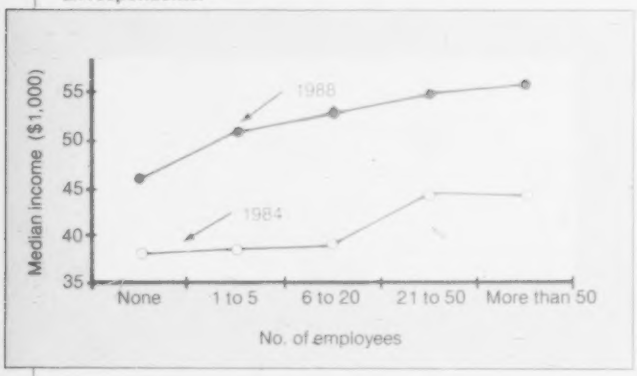


FIGURE 5. **Income and number of years of management experience, all respondents.**

- 64.6% manage at least a team or unit
- 58.5% have bachelor's degrees
- 27.1% have advanced degrees
- The average respondent has been with his or her present employer 11 years and has changed employers only once
- 38.1% came from another industry

Morale

- On a scale of 1 (bad) to 5 (good), 61.4% ranked their job morale as above average (4)
- 90% say they like their job
- 86.8% say they would stay in the paper industry if they changed jobs

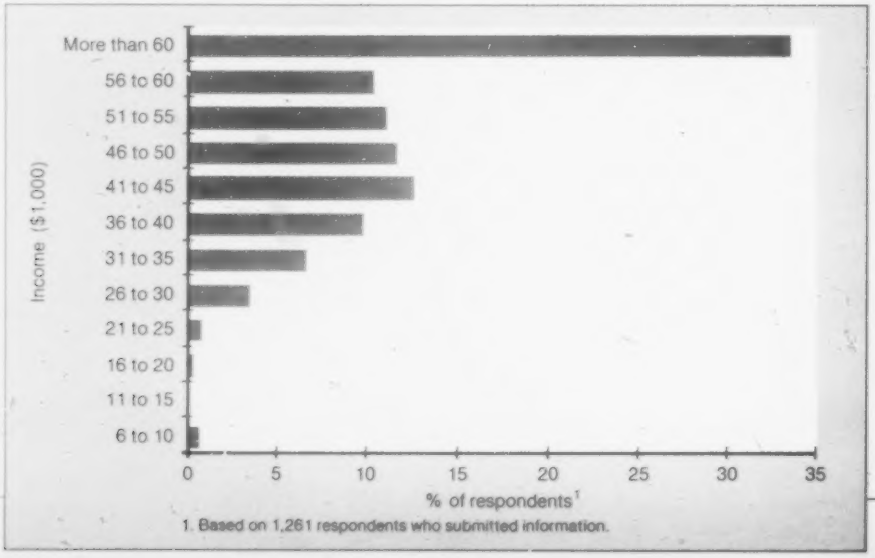
TABLE 1. **Salary distribution of all respondents.**

	Salary ($1,000)		
	1988	1984	% change 1984-88
Lower decile	35	30	16
Lower quartile	42	36	16
Median	53	44	20
Upper quartile	66	55	20
Upper decile	85	70	21

TABLE 2: **Benefits of respondents.**

	% of respondents	
Benefit	1988	1984
Medical insurance	92.8	92.7
Life insurance	89.8	91.3
Profit sharing	37.1	57.9
Retirement pension plan	83.8	86.1
Company car	12.2	41.1
Bonus plan	31.8	35.9
Stock option plan	39.5	34.9
Dental insurance	78.5	47.0
Travel budget	24.7	16.5
Education allowance	47.2	27.0

FIGURE 6. **Income distribution of respondents.**



1. Based on 1,261 respondents who submitted information.

- 84.8% say their company listens to their input and values their experience.

ANALYZING THE RESULTS. Tables 1 through 10 and Figures 1 through 5 present survey findings on compensation compared with a number of variables, including degree, discipline, work type and experience, size and type of employing organization, and supervisory level. Income figures reported in all tables were obtained by adding any bonuses or additional income reported by respondents to their reported gross salaries.

The profile of our average 1988 survey respondent is very similar to that of 1984's survey. The 20% increase in median salary (Table 1) over the four years seems to reflect steady growth in the industry.

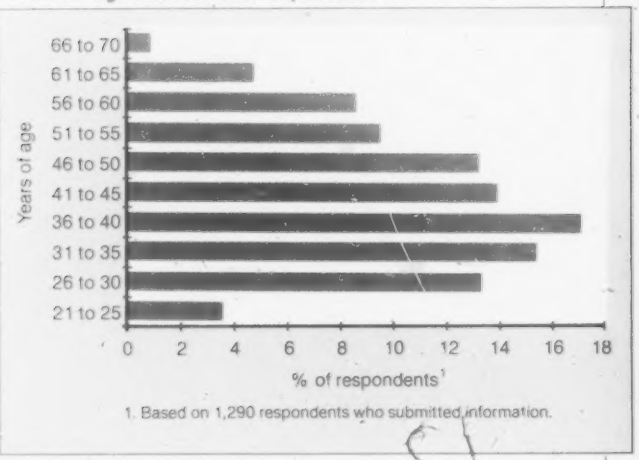
Table 2 shows a 20.8% decrease between 1984 and 1988 in the number who take part in company profit-sharing plans and a 28.9% reduction in the number who use company cars. But respondents who receive dental insurance increased 31.5%, and those who receive an education allowance increased 20.2%. More employees are traveling, or the cost of travel has increased, as evidenced by an 8.2% increase in travel budgets.

Table 3, comparing income and type of employment organization, shows self-employed consultants have a $70,000 median income. Respondents who work at consulting firms and wood products and pulp and paper supplier companies tied with a median income of $60,000.

A comparison of principal work function with median income (Table 4) shows that the highest median salary ($69,000) belongs to those in administration. Salaries of consultants ($64,000) inched closer to administration salaries. The largest percentage increase in salaries during the four years occurred with those working in product development—going from $38,000 in 1984 to $56,000 in 1988, an increase of 47%. Salaries in teaching/academics made a 41% jump.

No clear trend can be seen in Table 5, which relates size of the employing organization with median income, except that those respondents who do not know the amount of their companies' annual sales have a consid-

FIGURE 7: Age distribution of respondents.



1. Based on 1,290 respondents who submitted information.

TABLE 3: Income and type of employment organization, all respondents.

	Income ($1,000)					
Employing organization	**Lower decile**	**Lower quartile**	**Median**	**Upper quartile**	**Upper decile**	**% change in median 1984-88**
Academic	33	33	55	62	63	22
Government	31	31	31	31	31	0
Wood/pulp/paper—engineering	37	44	56	68	80	24
Wood/pulp/paper—manufacturing	34	41	50	64	82	13
Consulting firm	40	50	60	70	80	17
Self-employed consultant	55	65	70	100	100	16
Wood/pulp/paper—supplier	38	47	60	75	95	33
Wood/pulp/paper—converter	28	40	53	83	108	26
Other	30	45	56	70	82	24

TABLE 4: Income and principal work function, all respondents.

	Income ($1,000)					
Principal function	**Lower decile**	**Lower quartile**	**Median**	**Upper quartile**	**Upper decial**	**% change in median 1984-88**
Administration	40	50	69	95	135	18
R&D	32	38	47	63	81	4
Consulting	51	57	64	72	80	27
Engineering design	38	44	54	63	78	25
Teaching/academic	55	55	55	62	62	41
Product development	40	47	56	66	71	47
Production and mill/plant oper.	36	43	52	67	85	15
Engineering/maintenance	35	42	51	59	72	27
Sales and marketing	33	45	58	68	91	18
Technical service/quality control	31	37	44	53	65	12
Other	28	39	51	70	89	27

erably lower median income than those who do know.

As would be expected, the highest median income ($95,000) was reported by those at the corporate management supervisory level. As in 1984, the median income of all respondents corresponds directly to their level of supervisory responsibility (Table 6).

Figure 1 shows that median income increases with years of professional experience through 34 years. After that point, the correlation is not as clear and seems to confirm the problem of salary compression.

As in 1984, Table 7 may present misleading data comparing income and educational field. Business and forestry/agriculture majors claimed the highest median income ($57,000). Five groups tied for second with $56,000 in median income. However, each group represented only a small number of respondents, making the data difficult to analyze statistically.

Table 10 shows that job hopping seems to pay off, with a steady increase in median income as the number of employers increases. Those with six or more employers reported making $60,000, compared with an income of $46,000 for those who have had only one employer.

Job stability (or perserverence/experience) does pay, according to Figure 2. However, some of the data may be unreliable, as shown by the peak of respondents from six to ten years, followed by a drop and then a slow rise.

The editors of *Pulp & Paper* hope this survey will be useful to our readers. Comments on how it can be improved or comments on the magazine in general are always appreciated and should be addressed to: Projects Editor, *Pulp & Paper*, 2700 Cumberland Parkway N.W., Suite 530, Atlanta, Ga. 30339. ■

TABLE 5. **Income and size of employing organization, all respondents.**

Organization's annual sales (million $)	Income ($1,000)					
	Lower decile	Lower quartile	Median	Upper quartile	Upper decile	% change in median 1984-88
Less than 100	33	42	55	68	100	25
100 to 49	30	40	52	65	81	13
500 to 999	33	43	53	66	85	17
1,000 to 2,000	36	42	53	68	85	15
More than 2,000	37	44	55	68	86	25
Do not know	31	36	44	56	62	15

TABLE 6. **Income and level of supervisory responsibility, all respondents.**

Supervisor responsibility	Income ($1,000)					
	Lower decile	Lower quartile	Median	Upper quartile	Upper decile	% change in median 1984-88
None	31	36	44	54	66	22
Indirect or staff	31	38	46	57	66	17
Team or unit	35	41	49	58	68	16
Project or section	36	46	53	64	75	17
Major department or division management	42	52	66	80	101	22
Corporate management of organization	53	70	95	122	250	35

TABLE 7. **Income and educational field—bachelor's degree only, all respondents.**

Discipline	Income ($1,000)					
	Lower decile	Lower quartile	Median	Upper quartile	Upper decile	% change in median 1984-88
Forestry/agriculture	30	42	57	75	89	16
Chemistry	37	45	54	64	80	12
Mechanical engineering	39	46	56	69	82	27
Chemical engineering	37	43	53	66	82	15
Civil engineering	40	43	56	68	87	24
Electrical engineering	40	49	56	65	80	16
Industrial engineering	28	42	51	55	65	15
Mathematics/physics	32	33	50	70	77	8
Computer science	0	0	0	0	0	-100
Biology/life science	26	31	38	48	65	8
Paper science and technical	35	39	49	61	85	19
Environmental science	36	46	56	70	77	47
Business	37	46	57	72	100	16
Liberal arts	29	35	53	65	96	5
Other	34	41	56	71	95	27

Years since bachelor of science degree	Highest degree	Income ($1,000) Lower decile	Lower quartile	Median	Upper quartile	Upper decile	% change in median 1984-88
0 to 4	B.S.	30	35	37	39	42	0
	M.S.	40	40	43	45	45	30
	Ph.D.	41	34	35	49	49	-5
5 to 9	B.S.	30	36	44	51	53	0
	M.S.	45	49	54	61	62	-
	Ph.D.	34	44	49	57	62	-14
10 to 14	B.S.	34	43	52	60	68	-7
	M.S.	48	58	65	72	80	27
	Ph.D.	39	40	53	67	80	-22
15 to 19	B.S.	43	48	55	66	87	9
	M.S.	52	60	67	80	93	0
	Ph.D.	42	54	70	89	117	66
20 to 24	B.S.	43	51	65	72	74	32
	M.S.	45	56	70	90	101	40
	Ph.D.	49	51	57	63	80	-1
25 to 29	B.S.	47	59	81	95	107	55
	M.S.	53	53	80	80	107	35
	Ph.D.	51	54	60	65	105	0
30 to 34	B.S.	53	56	68	78	78	3
	M.S.	72	72	93	93	160	0
	Ph.D.	54	54	60	80	91	0
35 to 39	B.S.	10	60	65	80	90	71
	M.S.	56	56	58	77	108	45
	Ph.D.	68	68	112	112	426	166
40 to 44	B.S.	74	74	74	116	116	42
	M.S.	0	0	0	0	0	100
	Ph.D.	0	0	0	0	0	-100
More than 44	B.S.	80	80	80	80	80	42
	M.S.	0	0	0	0	0	-100
	Ph.D.	0	0	0	0	0	0

TABLE 8: Income, professional experience, and educational level, all respondents.

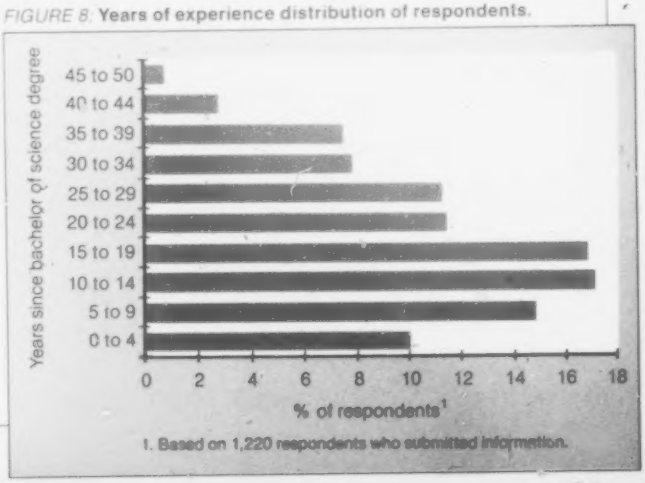
Years since bachelor of science degree	Forestry/ agriculture	Chemistry	Income ($1,000) Mechanical engineering	Chemical engineering	Civil engineering
0 to 4	0	41	35	38	37
5 to 9	28	44	41	45	41
10 to 14	42	45	50	50	43
15 to 19	57	54	57	57	56
20 to 24	0	63	58	63	88
25 to 29	70	53	66	69	59
30 to 34	60	68	68	61	75
35 to 39	51	48	70	78	70
40 to 44	0	75	80	70	56
More than 44	0	0	65	80	0

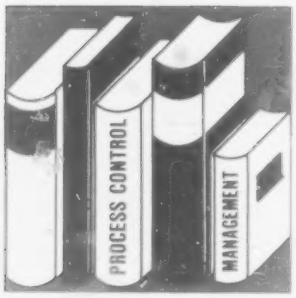
TABLE 9: Income, professional experience, and educational field—bachelor's degree only, all respondents.

TABLE 10: Income and number of full-time employers, all respondents.

Employers	Income ($1,000) Median	% change in median 1984-88	Respondents
1	48	15	361
2	53	20	369
3	56	19	207
4	57	16	126
5	58	16	86
6 or more	60	22	43

FIGURE 8: Years of experience distribution of respondents.





ENGINEERING: Staffing/Training

U.S. PAPER SCHOOLS STRUGGLE TO MEET THE INDUSTRY'S DEMAND FOR ENGINEERS

Changing demographics and more popular fields have left schools short on students at a time when companies need more engineers

By KELLY H. FERGUSON, Projects Editor

Asked if their institutions are keeping up with industry demands, U.S. paper school officials will likely answer "No." The need for qualified engineers is at an all-time high in the North American paper industry due to record level capital spending and a growing backlog of mill projects, from standard performance upgrades to major greenfield expansions. Engineers with paper technology backgrounds are scarce, to say the least, and most engineering firms are finding them wherever they can.

But being able to offer good jobs to graduate engineers is not enough to attract qualified students to paper schools. In fact, job offers have never really been a problem, even in some of the industry's worst down cycles. Today, paper schools are facing other, less objective enrollment problems that could threaten the future supply of specialized engineers in the paper industry.

The number of students going to college has dropped overall, and interest in business-related fields is heavy. This has caused a decline in enrollment at paper schools, and some officials say that this decline may continue for some time.

Past surveys have shown the paper industry getting 10% to 20% of its technical work force each year from pulp and paper schools. Most of these schools have watched their programs decline, others have not yet seen a decline. Their reactions range from boosting recruitment to almost ignoring the manpower shortage and maintaining a steady program. Several factors affect their philosophies for dealing with the decline, including school size, geographic location, and past placement performance.

At some schools, the number of scholarships and their amounts have been increased to attract talent. Most schools, in recruiting top high school students, tell prospects of high starting salaries and an abundance of jobs in an industry running at almost full capacity.

But some school officials say trying to meet the immediate needs of an employee-hungry industry by recruiting heavily could lead to dumping once the good times disappear. A few said they saw no damaging effect from attempts to boost enrollment, but at the same time they said they would not increase recruitment until it was warranted.

DECLINING ENROLLMENT. Of the seven schools surveyed by *Pulp & Paper*, four reported a decline in program enrollment in the past few years. Three schools said their programs had been static or had fluctuated only slightly.

North Carolina State Univ's Dean Eric Ellwood, in an address to the school's pulp and paper foundation, stated that "the forestry schools of the nation have suffered a 47% reduction in enrollment; however, the pulp and paper curriculum has suffered only a 20% drop since 1979."

At the base of the decline is the aging of the U.S. population. "Our enrollment has dropped, and the drop has mirrored the demographic data—the availability of col-

lege-age people," said James Bambacht, a professor in the College of Environmental Science & Forestry at the State Univ. of New York.

David Kraske, Univ. of Maine at Orono's department chairman for chemical engineering, pointed out that "the baby boom engineers are graduated, and the industry is facing a 10- to 15-year drought, possibly longer." Maine has experienced a slight enrollment reduction.

The declining number of qualified, college-age students means a fight among industries to attract those students. This is a fight, some school officials say, that the pulp and paper industry must join.

"Students are going to computer science, electrical engineering, and business. That is where the enrollment in the universities is now," said Richard Thomas, wood and paper science department chairman at N.C. State. Dr. Thomas said the university has experienced an enrollment decline and has been recruiting vigorously to overcome it.

Miami Univ. had been experiencing an enrollment decline, according to R.C. Peterson, executive director of the Miami Pulp & Paper Foundation. Peterson pointed to strong recruiting as the reason for its jump from 25 freshmen last year to 38 enrolling for the coming academic year. Western Michigan Univ. at Kalamazoo also experienced a decline.

Two schools, the Univ. of Wisconsin at Stevens Point and the Univ. of Washington, have had no decline. Wisconsin's Larry Graham, department chairman of paper engineering and science, said, "A few years ago, our incoming freshmen enrollment declined from about 85 or 90 to about 70, but that was more a reflection of increased enrollment standards at the university. We've remained at about 70 freshmen since then."

RECRUITING STUDENTS. Donald F. Root, executive director of Washington's Pulp & Paper Foundation, said the school has seen no decline in enrollment, but he points to Washington's smaller program and the area from which it draws students. "We've found it easy to meet our enrollment targets without a very aggressive recruiting effort. If we recruited more vigorously, we'd be overwhelmed by applicants."

Wisconsin is another school that has not felt the need to increase recruiting. "We've been able to fill our need for students with a fairly minimal effort," Dr. Graham said. "We are lucky geographically because we have potential students who are aware of the industry and aware of the opportunities."

David Peterson, associate professor at Western Michigan, said it has made no specific efforts to bring more students to the school, but it has begun distributing a videotape to launch a recruiting effort.

Maine uses seminars aimed at high school students along with recruiter visits to push its program. Kraske said, though, that the industry may be relying too heavily on schools. "The industry is allowing academia to do the recruiting and is not promoting its own interests. The industry must become much more active in reaching candidates for universities and getting them interested in engineering."

N.C. State has the largest recruiting area of the schools surveyed, visiting about 32 cities from North Carolina to East Texas. Dr. Thomas said most of the school's recruiting is in cooperation with industry. "We go to mill sites and talk to students the companies bring in." The school also conducted a recruitment training seminar in August with representatives from 15 mills from around the country.

"Students, generally, will go where the money and the jobs are, and that's the message that needs to be sent to high school students," Dr. Thomas said. "Year after year, we're among the highest starting salaries on this campus. That's the kind of information that needs to get out."

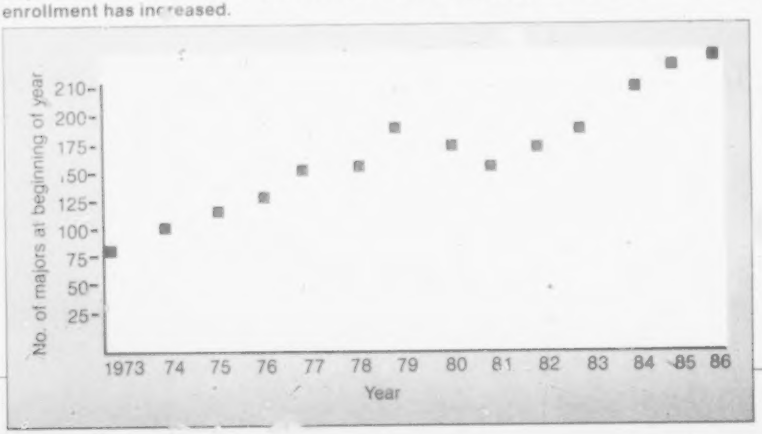
"BUYING" STUDENTS. The paper industry is not popular with high school students (see sidebar). More than ever, students are looking for glamour and a way to pay their tuition bills when they make career deci-

TABLE 1. **Enrollment trends at N.C. State Univ.'s Dept. of Wood & Paper Science from 1978 to 1988.**

Year	Freshmen enrollment	Undergraduate enrollment	Degrees granted
1978	44	147	26
1979	68	173	27
1980	65	190	25
1981	77	195	34
1982	62	188	26
1983	58	189	39
1984	51	178	21
1985	44	159	29
1986	53	158	30
1987	39	142	17
1988[1]	39	150	—

1. 1988 figures are estimated.

FIGURE 1. **Enrollment trends from 1973 to 1986 for the Paper Science & Engineering Dept. at the Univ. of Wisconsin, Stevens Point, one of only a few schools whose enrollment has increased.**



sions. Therefore, recruiters are just window shopping for talent unless they can offer financial incentives—namely scholarships.

"It's the resources that are needed—the dollars to provide scholarships—because schools have to 'buy' the talent. They won't get it any other way," Dr. Thomas said. "We buy a lot of students. At N.C. State, a student can earn a degree in pulp and paper in eight semesters and, by staying another semester, can earn a degree in chemical engineering. So we are able to buy chemical engineering students."

As part of its recruiting drive, Miami's Pulp & Paper

The invisible industry

The paper industry has an image problem. In reality, most people know little or nothing about its varied products, much less its complex processes. Unlike the petroleum industry, for example, it has no real or glamorized tycoons—no Ewings, Gettys, Pickens, Iacoccas, etc. We have no paper magnates, no pulp sheiks, and no paper cartels to grab the attention of the international media.

Most likely, the public as a whole associates the paper industry with small towns, bad odors, and lingering labor problems. Certainly, it is not seen as a "trendy" business with many glamour trappings to attract today's image-conscious students. But possibly as bad, it may not have much of an image at all.

Recruiting bright, high-performance high school graduates for careers in papermaking is not an easy task today, considering the allure of other, more glamorous professions. With the current shortage of engineers to handle a backlog of expansion/modernization projects that is expected to grow even larger next year, this could become a major problem.

North Carolina State Univ.'s "Pulp & Paper Foundation 1987 Annual Report" commented on image in the student recruitment committee report, written by Robert C. Harrison. "Heavy competition in a shrinking market is further complicated by what remains a continuing poor industrial image of the pulp and paper industry vs the surging reputation of 'glamour' career patterns in investment banking, high technology, computers, etc."

"Paper is such a common commodity. It's one of those things that you take for granted," said Western Michigan Univ.'s David Peterson. "We have not had a shortage, so it is taken for granted. When you look at what paper is, it looks simple and not particularly interesting."

N.C. State's Richard Thomas said, "The pulp and paper industry basically has no image. I've had mothers and fathers of students who have accepted scholarships ask me 'Well, what is pulp and paper?' "

"A lot of people don't even know about the pulp and paper industry," said R.C. Peterson of Miami Univ. "That's the biggest problem. Pulp and paper companies don't advertise on networks about the importance of the paper industry on the economy. I would say there's not an image problem; there just is no image. The industry is what many people call 'the invisible industry.' "

But some say the pulp and paper industry has an image—a bad image. Environmentalists' accusations, pollution problems, and labor confrontations have often put pulp and paper companies in the media spotlight.

"The pulp and paper business is at a disadvantage," said David Kraske of the Univ. of Maine at Orono. "Take Maine, for example, and look at the labor relations climate that has been associated with the pulp and paper industry here. Add to that the volume polluter in Maine is still the pulp and paper industry. Add that to the picture of the industry as a whole. Some people regard that not as opportunity but as real a image buster. Pulp and paper is not a glamour industry."

Some companies do advertise in the print media, but normally those advertisements are aimed at the business community. Miami's Peterson noted, "While companies make pitches for the public to buy stock, they aren't pitching to the young people."

Is there a solution? Even when the industry is doing well, little is mentioned in the press about it.

"I think all the negative things that are in the media relative to American industrial competitiveness have not highlighted the pulp and paper industry in what, I think, is the only smokestack industry in the U.S. that is truly internationally competitive, at least in some areas," said Peterson.

"When you begin to look at the varieties of paper, the way it is used, and the varieties you make from a single source of fiber, paper begins to be more interesting," said Western Michigan's Dr. Peterson. "Our objective is to get young people to look at the challenges that are in the industry, and then I think we can turn a lot of people on to it."

N.C. State's recruitment committee will "spend considerable time describing the fundamentals of the pulp and paper industry, summer employment, starting salaries, professional opportunities within the industry, as well as the actual track record of our alumni," according to Harrison's report.

"In addition, we are revising our brochure to reflect this emphasis as well as collecting considerable public relations information from our primary member companies in order to help neutralize and remove any negative image our industry might have in the eyes of a high school candidate and his or her parents," Harrison wrote.

But one area where the industry image is not so tarnished or lacking is the mill town. Most pulp and paper schools reinforce that positive image with heavy recruitment in a place they know will give them support.

According to Kraske, "The paper industry suffers from an image problem, and they've got to work to defeat [it]. They can do that by educating the people who live in mill towns. They do that already, to some degree. We wind up here with students who are interested in the paper business because their parents have been in the paper business."

Foundation voted to provide more freshman scholarships and add a "premium scholarship" aimed at the very top students, Peterson said.

Other schools, like Syracuse, said that they have not raised scholarships because they have always had generous policies.

Kraske, in reference to his forecast of a student drought, said that "maybe the industry should think about subsidizing an engineering education—accepting a base-level engineer then funding his or her schooling for another year."

TABLE 2: **Miami Univ.'s Dept. of Paper Science & Engineering enrollment figures for fall term 1977 to 1987.**

Year	Freshmen	Sophomores	Juniors	Seniors	Fifth-year students	Graduate students	Total	New students
1977-78	58	45	49	34	2	12	200	84
1978-79	60	44	39	49	9	15	216	77
1979-80	55	41	43	47	2	26	214	75
1980-81	52	50	36	42	10	24	214	85
1981-82	39	40	44	35	10	28	196	55
1982-83	50	37	34	44	10	30	205	72
1983-84	31	36	30	36	14	24	171	58
1984-85	35	19	35	28	18	19	154	45
1985-86	34	30	15	33	16	17	145	47
1986-87	25	26	28	16	23	14	132	46
1987-88	26	23	22	26	13	19	129	41

REACTION OR OVERREACTION. Heavy recruiting at a time when the industry is at a peak risks the possibility of too many graduates and not enough jobs when a downturn occurs.

"I think there is a potential problem," Kraske emphasized. "Right now we're experiencing very good times, but the cycle will eventually swing the other way. When the downturn happens, and we have increased enrollment, we could have a disastrous placement year.

"If you try to build student enrollment during the peaks, it's going to create problems in the valleys. To keep a good level of entering students, schools must make sure students are being placed. It doesn't take long for information about poor placement to get down to the high schools. Our key attraction is good placement."

Syracuse's Dr. Bambacht agrees. "One of the things we have to avoid is overreacting to a crisis situation. The supply of engineers is a cyclic thing, and the current problem will probably solve itself."

N.C. State's Dr. Thomas said he sees recruitment as an industry-driven need for workers that has always existed. "I can recall only two years in the 30 years I've been here that we have not had 100% placement. And by 100% placement, I mean placement at, or even before, the time of graduation."

Other school officials also report excellent placement records. At Western Michigan, "We've had 100% placement since our program started in the late 1940s. Some of our students will have jobs before they graduate. Usually they'll have several to choose from. In the worst times, they've had one or two," said Dr. Peterson.

At Washington, "I still sense a very strong market for our graduates. Even during the prolonged period in the first half of the 1980s, we placed our graduates," Root said.

According to Dr. Thomas, "When times are good, everybody gets hired. When times tighten up, only the best get hired. We tell that to students."

TABLE 3: **Undergraduate enrollment by class from 1982 to 1986 for Western Michigan Univ.'s Dept. of Paper & Printing Science & Engineering.**

	1982	1983	1984	1985	1986
Freshmen	52	52	47	29	18
Sophomores	29	46	36	39	20
Juniors	39	22	41	22	35
Seniors	55	55	42	44	36
Others	5	2	3	1	0
Total	**180**	**177**	**169**	**135**	**109**

WHERE THE GRADUATES GO. No longer are these young engineers going straight to the pulp and paper companies. Many companies are reducing their engineering staffs and using support companies and consultants instead.

Miami's Pulp & Paper Foundation, in its 1987 annual report, stated that a survey of 74 alumni graduated since 1984 showed "a marked increase in the number of graduates whose first position was with an engineering or equipment company."

The chairman of Miami's Paper Science & Engineering Dept., William E. Scott, wrote in the annual report that "placement was excellent, with all students who sought jobs finding them. Of the 30 students who graduated, 15 took positions with paper companies, 13 went with suppliers, and two elected to continue in graduate school."

Washington's Root also noted the trend. "There is not so much an enhanced demand from the primary producers but from the suppliers—engineering companies, consulting companies, machine suppliers, and chemical suppliers. Also, considerable restructuring is going on. The industry is reducing the layers of employees.

"I think we're experiencing a temporary phenomenon caused mainly by a tremendous surge in capital investment. Companies can't get enough engineers to carry out essential projects. And some companies aren't taking on any new business because of that." ■